

What is Claimed is:

1. An apparatus for testing properties of a semiconductor laser wafer, the apparatus comprising:
 - a chuck receiving a wafer to be tested;
 - a pump light source directing a pump light beam toward selected locations on the wafer;
 - a light detector detecting light emitted from the wafer; and
 - a pump beam aiming mechanism selectively varying a position at which the pump light beam enters the wafer.
2. The apparatus according to claim 1, further comprising a light detector positioning mechanism moving the light detector to a position corresponding to a current position at which the pump light beam enters the wafer.
3. The apparatus according to claim 1, further comprising a mirror disposed parallel to a wafer receiving surface of the chuck.
4. The apparatus according to claim 3, wherein the mirror is external to a lasing cavity of the wafer and is shaped to define a mode supported by the lasing cavity of a wafer currently being tested.

5. The apparatus according to claim 1, further comprising a measuring system determining a position of the pump light source relative to the wafer.

6. The apparatus according to claim 1, wherein both the pump light source and the light detector face a first side of the wafer.

7. The apparatus according to claim 5, wherein the pump light beam of the pump light source impinges on a wafer received on the chuck at a selected angle.

8. The apparatus according to claim 1, wherein the pump light source faces a first surface of the wafer, and the light detector faces a second surface of the wafer.

9. The apparatus according to claim 1, wherein the chuck is substantially transparent to the pump light beam.

10. The apparatus according to claim 1, further comprising a wafer clamp adapted for retaining a wafer to be tested in a predetermined position on the chuck.

11. A method of wafer-level testing semiconductor laser devices, comprising the steps of:
positioning a wafer to be tested in a predetermined position relative to a pump light source;

optically pumping preselected regions of the wafer with the pump light source; and analyzing laser light emitted from each of the preselected regions to determine lasing characteristics of the preselected regions.

12. The method according to claim 11, further comprising the step of generating a two dimensional map of lasing characteristics of the wafer based on the analysis of the emitted laser light.

13. The method according to claim 11, further comprising the step of mapping a reflectivity spectrum of epitaxial layers of the wafer.

14. The method according to claim 11, further comprising scanning the epitaxial layers of the wafer to characterize surface roughness.

15. A method of manufacturing semiconductor laser devices on a wafer, comprising:
growing epitaxial layers on the wafer, the epitaxial layers forming at least one mirror and an active gain region;
optically pumping selected regions of the active gain region with a pump light source;
analyzing laser light emitted from each of the regions in response to the optical pumping; and

identifying the regions having acceptable characteristics based on the analysis of the emitted light.

16. The method according to claim 15, where the regions corresponding to the semiconductor laser devices are sequentially optically pumped along successive rows and columns of the regions.

17. The method according to claim 15, further comprising the steps of:
performing post epitaxial growth processing on the wafer;
separating the wafer into individual semiconductor laser devices;
sorting the individual semiconductor laser devices based on the analysis of the emitted light.

18. The method according to claim 17, wherein the step of performing post epitaxial growth processing on the wafer includes forming an electrical contact on the wafer.

19. The method according to claim 15, further comprising the step of discarding the wafer when a percentage of regions having acceptable characteristics does not exceed a selected percentage.

20. The method according to claim 15, further comprising the step of disposing an external mirror in proximity to the wafer before optically pumping, the external mirror

defining modes of the emitted laser light.

21. The method according to claim 18, further comprising the step of electrically probing individual laser devices via the electrical contacts.

22. A method of manufacturing semiconductor laser devices, comprising:
growing epitaxial layers on a substrate defining at least a mirror region and an active gain region;
optically pumping selected portions of the active gain region with a pump light source;
analyzing light emitted from each of the selected portions in response to the optical pumping to determine laser-related characteristics of the epitaxial layers; and
performing post-epitaxial growth processing on at least one of the substrate and the epitaxial layers.

23. The method according to claim 22, wherein performing post-epitaxial growth processing includes adding to the selected portions at least one of electrodes, insulators, and metal components defining the laser devices.

24. The method according to claim 22, further comprising the step of disposing an external mirror in proximity to the epitaxial layers before optically pumping the selected portions.

25. A method of manufacturing semiconductor laser devices on a wafer, comprising:

- growing epitaxial layers on the wafer, the epitaxial layers forming at least one mirror and an active gain region;
- optically pumping selected regions of the active gain region with a pump light source;
- analyzing laser light emitted from each of the selected regions in response to the optical pumping; and
- identifying the wafer for sorting based on the analysis of the emitted light.

26. The method according to claim 25, where the regions corresponding to the semiconductor laser devices are sequentially optically pumped along successive rows and columns of the regions.

27. The method according to claim 25, further comprising the steps of:

- performing post epitaxial growth processing on the wafer if the wafer is identified as having a selected characteristic.

28. The method according to claim 27, wherein the step of performing post epitaxial growth processing on the wafer includes forming an electrical contact on the wafer.

29. The method according to claim 25, further comprising the step of discarding the

wafer when the wafer is identified for sorting as failing to meet a selected criterion.

30. The method according to claim 25, further comprising the step of disposing a mirror in proximity to the wafer before optical pumping.

31. The method according to claim 25, wherein the mirror disposed in proximity to the wafer before optical pumping is external to the active gain region.

Abstract

A system and method for manufacturing and wafer-level testing properties of a wafer comprises a chuck receiving a wafer to be tested and a pump light source directing an output beam toward selected locations on a wafer received on the chuck in combination with a laser light detector detecting light emitted from the wafer and a pump beam aiming mechanism selectively varying a position at which the pump light source output beam enters the wafer.